

## Topic Study Group 36

### Research on Classroom Practice at Primary Level

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**ABSTRACT** The aim of TSG-36 was to share the experiences of research on classroom practice at the primary level, address its research methods and theories, describe innovative classroom practice, and discuss the impact of research on classroom teaching and learning mathematics in different countries. A total of 32 submissions of research articles, project reports, and posters addressed related topics.

*Keywords:* Classroom practice; Primary level; Integrating technology; Action research; Teacher education.

#### 1. Themes and Description of TSG-36

##### 1.1. *The aim of TSG-36*

The aim of TSG-36 at ICME-14 was to share the experiences of research on classroom practice at the primary level, discuss its methods developed, and address its impact on classroom teaching and learning mathematics in different countries. The experiences of research on classroom practice can come from various levels of practitioners, educators, and researchers. The complexity of teaching practices in the current rapidly-developing technology era raises a variety of questions for research on classroom practice, such as teacher as researcher, how to use research-based teaching strategies and evidence-based teaching strategies to support effective classroom teaching, appropriate methods for classroom teaching research that informs teaching practice, development of multidisciplinary integration (STEM) projects in mathematics classrooms, effective methods for different teaching approaches, using new technologies in classroom teaching research, effective collaboration on classroom teaching research between classroom teachers and researchers, and effective training

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programs for research expertise in higher education and professional development. The principles of teaching have been addressed in many national standards, but there is no clear answer on the principles of effective instruction in elementary mathematics classrooms. These challenges call for action to reflect and discuss important needs in research on elementary classroom practice. The TSG-36 explored state of the art strategies and approaches to address the concerns and problems, and advance the research on classroom practice at the primary level from international perspectives with an ultimate goal of supporting elementary mathematics classroom teaching and learning.

### ***1.2. Themes and description of TSG 36***

TSG-36 included the following four themes from:

- *Theme 1.* Empirical studies that investigate using effective classroom practices to support teaching and learning elementary mathematics, integrating technology and/or STEAM education into elementary classrooms, assessing student mathematics learning outcome, and using adaptations to support diverse student mathematics learning.
- *Theme 2.* Effective programs and projects related to teachers as researchers who conduct action research in practices which support effective classroom teaching and learning.
- *Theme 3.* The challenges, diverse and emerging research methods, and tools of effective research on classroom practice at the primary level.
- *Theme 4.* Effective approaches in training and developing expertise in research on elementary classroom practice in teacher education programs and in professional development for classroom teachers.

## **2. Program Overview**

### ***2.1. Format of TSG-36***

The format of TSG-36 was a hybrid format — onsite and online meetings synchronously.

### ***2.2. Submissions of TSG-36***

A total of 32 submissions were received from 16 countries (Canada: 1; China, including Chinese Taipei: 9; Denmark: 1; France: 1; Germany: 1; India: 1; Italy: 1; Japan: 3; Malaysia: 1; Mexico: 1; Sweden: 1; Switzerland: 1; The Philippines: 1; UK: 1; USA: 7; Uzbekistan: 1). These submissions cover a variety of important topics in four TSG-36 subthemes by authors from different cultural backgrounds and countries.

Of the 32 submissions, 15 were accepted as paper presentations (seven long presentations and eight short presentations), seven as posters, and 10 could not be presented.

### 2.3. Sessions and presentations

TSG-36 had three Class B sessions: sessions 1 and 2 had 90 minutes and session 3 had 120 minutes. Each session started with a brief introduction, followed by an invited talk, then long oral presentations, and short oral presentations, see Tab. 1. Each session also included at least 20 minutes' open discussion for participants to ask questions and reflect on their learning. In addition, each session included not only diverse topics on classroom practice at the primary level, but also included presenters from different countries and regions to provide an opportunity for participants to interact and exchange their research expertise among various scholars. Furthermore, session 3 provided a 35 minutes next step for the whole group discussion and reflection. The following tables show the papers presented in the three sessions:

Tab. 1. List of papers presented in session 1

Paper and author(s)
<b>Session 1</b>
[1] The benefits of using videos from research studies for teacher education: attending to students reasoning and argumentation. <b>Carolyn A. Maher</b> (USA).
[2] Examining U.S. elementary teachers' perceptions of and comfort with students' mathematical mistakes. <b>Jinqing Liu</b> (USA), <b>Dionne Cross Francis</b> (USA), and <b>Ayfer Eker</b> (Turkey).
[3] Problems with variation: an educational experience of cultural transposition with prospective Primary teachers. <b>Benedetto Di Paola</b> (Italy).
[4] Shanghai practice of primary mathematics classroom activities. <b>Min Zhang</b> (China).
<b>Session 2</b>
[5] Conjecturing teaching as competency-based instruction. <b>Pi-Jen Lin</b> (Chinese Taipei).
[6] How does a Japanese primary school teacher manage the whole-class discussion named Neriage? <b>Valérie Batteau</b> (Switzerland).
[7] Teaching mathematics at Mexican elementary schools. <b>Edith Arévalo Vázquez</b> , <b>Hilda Alicia Guzmán Elizondo</b> , and <b>Elvira Alicia Sánchez Díaz</b> (Mexico).
[8] Action-research group on Go game as classroom practice to learn mathematics at primary level. <b>Antoine Fenech</b> and <b>Richard Cabassut</b> (France).
[9] A grade 2 teacher's shift in the use of mediational means within and across two addition lessons. <b>Fraser Gobede</b> (Malawi).
<b>Session 3</b>
[10] Using math clinic to support classroom teaching practice and sharpen teachers' pedagogical content knowledge. <b>Shuhua An</b> (USA).
[11] Data use to inform mathematics instruction: an exploratory study. <b>Jong Cherng Meei</b> (Malaysia).
[12] Concept of collective milieu to understand the Japanese mathematics lesson. <b>Takeshi Miyakawa</b> (Japan), <b>Valérie Batteau</b> (Switzerland), and <b>Minbom Ryu</b> (Japan).
[13] Exploring the differences between expert and pre-service teachers noticing. <b>Yiru Pei</b> , <b>Min Chen</b> , and <b>Qiaoping Zhang</b> (Hong Kong SAR, China).
[14] From loser to user, from special to general education, learning Inside mathematics through outside actions. <b>Allan Tarp</b> (Denmark).
[15] Storytelling as a resource for fostering 'love of challenge' for mathematics in primary grade students. <b>Pooja Keshavan Singh</b> and <b>Haneet Gandhi</b> (India).

## **2.4. Main outputs**

The three TSG-36 sessions resulted many important outcomes. The main findings included the following:

### *2.4.1. Effective approaches in elementary classroom practice*

A number of studies addressed effective classroom practices in elementary classrooms. For example, Lin<sup>[5]</sup> introduced a conjecturing teaching model with five stages as a competence-based instructional approach. The development of the model was characterized into six periods of investigation. Each period had a focus for eliciting the model. Some studies used a lesson study or classroom teaching as a focus on data collection and analysis. For example, Batteau<sup>[6]</sup> analyzed teacher practices in a Japanese context with a focus on a specific phase of structured problem solving lessons, a whole-class discussion named *Neriage*. The study by Gobede<sup>[9]</sup> also observed teaching practice on mediational moves made by a grade 2 teacher while teaching the addition of whole numbers for the first time at this level and suggested the need to move further to more efficient calculation strategies.

Other presentations introduced interdisciplinary in mathematics classroom. For example, Fenech and Cabassut<sup>[8]</sup> demonstrated a game activity — Go game — as classroom practice to learn mathematics at the primary level by an action-research group. Singh and Gandhi<sup>[15]</sup> examined the cognitive engagement of primary grade students with a mathematical content that was embedded in the story situation. It was observed that the attachment of the students with the story characters motivated them to go beyond the basic requirements of the task, seek challenges and expand their vistas for more complex tasks. The study recommends storytelling as a resource for fostering a ‘love of challenge’ for doing mathematics with primary grade students. Zhang<sup>[4]</sup> introduced using three types of classroom activities — perceived experience, exploration and discovery, and understanding and application to stimulate students’ desire for inquiry, enhance students’ participation, improve students’ learning styles, and realize Mathematics Subject’s multiple-quality function and advantages in fostering qualified personals.

### *2.4.2. Teacher education programs for effective classroom practice*

Various presentations related to this theme. Maher<sup>[1]</sup> addressed the benefits of using videos on attending to students’ reasoning and argumentation from research studies for teacher education programs. Di Paola<sup>[3]</sup> studies effective approaches in training and developing expertise research on elementary classroom practice in teacher education programs and in professional development for classroom teachers. An’s study<sup>[10]</sup> examined the impact of Math Clinic on classroom teachers’ questioning strategies, understanding students’ thinking and misconceptions and their intervention strategies

of correcting errors in a mathematics graduate program. Using pre-recorded exemplary lessons, Pei et al.<sup>[13]</sup> examined the noticing ability among expert teachers and explores the difference and similarities between expert teachers and pre-service teacher's noticing on exemplary lessons via a multiple case study. The findings showed that the pre-service teacher has a relatively low noticing ability and tend to focus on the pedagogy and classroom environment.

#### *2.4.3. Important issues and challenges in elementary classroom practice*

The presentations in TSG-36 investigated important issues and also address various challenges in classroom practice at the elementary level. For example, a study by Liu et al.<sup>[2]</sup> examined seven U.S. elementary teachers' perceptions of and comfort with students' mathematical mistakes via interviews. The results showed that teachers believed mistakes are important for proactively teaching, essential for supporting student learning as well as for lesson planning. However, the challenge was that teachers did not feel very comfortable in addressing student mistakes. A study by Vázquez et al.<sup>[7]</sup> examined teaching mathematics in the categories of teaching strategies, forms of class organization, classroom organization, use of teaching materials, assessment tools and textbook at Mexican elementary school in public elementary schools in Mexico by assessing the practices of 70 elementary school teachers. The results show that despite the implementation of the current curriculum, most educators continue to use teaching strategies that are far from the suggested didactic recommendations. Meei<sup>[11]</sup> shared an exploratory study on data use to inform mathematics instruction by investigating the state of data use to inform instruction among primary school mathematics teachers in Malaysia.

Results of the questionnaire and interviews indicate that the data which was most frequently used was classroom-based assessment data. Although teachers indicated that training needs and support for data use were adequate and they were confident in using data to inform mathematics instruction, they also like to have more professional development courses so that they can use data effectively and systematically to inform their practice. Miyakawa et al.<sup>[12]</sup> addressed the concept of collective milieu to understand the Japanese mathematics lesson by highlighting a collective construction of the inquiry or the problem solving process step by step, in terms of the collective milieu due to a lack of theoretical tools to analyze the Japanese mathematics lessons with their specificities: the approach by problem solving, the collective dimension of the teaching, and the focus on the development of mathematical thinking. Based on the observation of how children communicate about Many before school, Tarp<sup>[14]</sup> indicated that accepting numbers with units means that counting, recounting and solving equations come before adding on-top or next-to introduce integral and differential calculus as well as proportionality in early childhood education.

### **3. Future Directions and Suggestions Themes**

#### **3.1. Future directions**

Throughout the presentations and discussions at three TSG-36 sessions, the participants explored and identified current and future trends, merging research themes, and areas of research interest for classroom practice at the primary level, as follows:

- (1) Training and developing expertise in teaching and research on elementary classroom practice for classroom teachers;
- (2) Training and developing expertise in teaching and research on elementary classroom practice in teacher education programs Role of expert teachers in teacher education programs;
- (3) Using videos in teacher education programs;
- (4) STEM Education in pre-service elementary teacher training program;
- (5) Using interdisciplinary approaches into mathematics instruction;
- (6) Data science in mathematics education;
- (7) Theoretical tools for analyzing mathematics lessons;
- (8) Innovative approach in early children education.

#### **3.2. Suggestions**

The participants enjoyed their learning from all presentations on diverse topics at TSG-36 sessions. Despite the promising results from the presentations, some questions remain unanswered at present. Future studies on the classroom practice at the primary level are therefore recommended:

- (1) Future work is suggested to design the effective training and profession development on the 21<sup>st</sup> century teaching and research expertise for elementary classroom teachers and pre-service teachers in teacher education programs;
- (2) Future work is suggested to establish the sound theoretical framework for research on using videos, classroom observations, and lesson studies;
- (3) Further research should be undertaken to explore topics related to current trends, such as: STEM, data science, and other innovative approaches.